South Dakota Walleye Regulation Toolbox

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Preface

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Executive Summary

The first South Dakota Walleye Toolbox was completed in 2009. The Toolbox was the result of increasing Walleye regulation complexity. The number of special Walleye regulations was reduced from nine to four. Additionally, the Toolbox provided criteria necessary for implementation and evaluation of regulations. This document is an update of the original Walleye Toolbox. In keeping with the objectives of the original Walleye Toolbox, the 2023 Walleye Toolbox keeps regulation complexity minimal and includes criteria for implementing and evaluating regulations.

Most South Dakota Walleye fisheries are managed with the statewide regulation and not with a special regulation. The statewide regulation is four fish daily with one ≥20 inches. The 2023 Walleye Toolbox contains the same 15-inch minimum length limit (MLL), 28-inch MLL, and experimental regulation category as the 2009 Walleye Toolbox, plus the addition of a protected slot limit (PSL). The regulations included are for Walleye fisheries with varying rate functions (i.e., recruitment, growth, and mortality), exploitation levels, and differing fishery objectives.

Three options are included under the 15-inch MLL: a four fish daily limit, a two fish daily limit, and a partial-year exemption. The overall objective of the 15-inch MLL is to protect fish <15 inches from harvest and increase the average fish size within a population. On lakes where angler exploitation is high, a reduction in the daily limit to two fish may distribute Walleye harvest more equitably and potentially extend periods of good fishing. The partial-year exemption allows for harvest of Walleyes <15 inches to help maintain growth rates and occurs when release mortality may be high because of warm water temperatures and/or fish are caught from deep water.

The 28-inch MLL regulation currently is in place on Horseshoe (Day County), Reetz, and Twin (Minnehaha County) lakes. This regulation can provide anglers with the opportunity for high catch rates of large Walleyes (≥20 inches), maintain a high abundance of large Walleyes for biocontrol of abundant undesirable fish species and/or panfish, and maintain high Walleye abundance in waters close to urban areas. The regulation has been successful at Reetz Lake and Twin Lake but has not been in place long enough at Horseshoe Lake to evaluate.

In the 2009 Walleye Toolbox, a PSL was an experimental regulation at Belle Fourche Reservoir. The PSL is now part of the Toolbox regulations. Protected slot limits can improve population size structure by harvesting slow-growing small fish and protecting fish within the protected slot. Anglers must be willing to harvest fish below the minimum length of the PSL for the regulation to be effective. The lower and upper limits have not been defined to provide managers with flexibility depending on Walleye growth rates and the objectives for the fishery.

The Toolbox also has an experimental regulation category for addressing unique management situations, creating unique fishing opportunities, or researching the effectiveness of new regulation types or ideas.

Proposed regulations are developed by aquatics staff within each Fisheries Management Area before being brought forward and identified as a possible new regulation. Regulation ideas need to be supported by biological data and be socially acceptable. New regulations pass through the South Dakota Department of Game, Fish and Parks (SDGFP) Aquatics Commission Rules Development (CRD) process. The SDGFP Commission can consult with SDGFP aquatics staff to determine how a public petition for a Walleye regulation change fits into the Walleye Toolbox before acting on a petition.

A 10-year evaluation plan will be required with the implementation of any regulation. All regulation changes, including citizen's petitioned regulation changes, will need to be evaluated through the collection of biological data. Walleye populations considered for a new regulation or as part of an evaluation of a regulation will be sampled with gill nets to determine relative abundance, size structure, condition, to estimate growth and annual mortality, and characterize recruitment. In many cases, human dimension data gained either through creel surveys or broader questionnaire surveys will also be used in the evaluation. At the end of the 10-year evaluation, a report of the findings will be completed, which will include a recommendation of whether or not the regulation should continue.

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Introduction

Walleyes are a favored species with anglers across South Dakota and throughout their range in the northern latitudes of North America (Schmalz et al. 2011). Because of the popularity of Walleyes, the South Dakota Department of Game, Fish and Parks (SDGFP) places an emphasis on managing Walleye populations to provide quality fisheries for anglers to enjoy. A part of Walleye management includes regulating angler exploitation (harvest). Walleye regulations primarily have included bag limits and length-based regulations. Bag limits have typically been enacted statewide and are generally deemed too liberal to reduce angler harvest (Isermann and Parsons 2011). Population-specific regulations including reduced bag limits and size limits, which are more restrictive than statewide regulations, have been used to reduce Walleye exploitation on a lake level (Schmalz et al. 2011). Choosing the correct regulation is complicated by having to jointly regulate and accommodate the desires of the various user groups of a fishery (Schmalz et al. 2016).

In response to increasing demand for Walleyes in South Dakota, the statewide Walleye daily limit was reduced from eight to six fish in 1984, and in 1990 the daily limit was again reduced to the current four fish daily limit. South Dakota began managing Walleyes in select waters with minimum length limits (MLL) in the early 1990s. The first use of a 14-inch MLL occurred in 1990 on three Missouri River reservoirs (Francis Case, Sharpe, Oahe) and Lake Kampeska. A proliferation of various Walleye MLLs across South Dakota waters occurred in the 1990s and early 2000s. A 16-inch MLL and one fish ≥20 inches was first enacted on Bitter, Cattail-Kettle, and Waubay lakes in 1999 to provide anglers with larger Walleyes in the creel. At lakes Hanson, Hayes, Iroquois, and Jones, a 17-inch (432-mm) MLL was established in 1999. On lakes Francis Case and Sharpe, the 14-inch MLL was changed to a 15-inch MLL with only one fish ≥18 inches in 1999. The addition of several eastern South Dakota lakes to the one fish ≥20 inches occurred in 2000 and 2001. The 14-inch MLL on Lake Oahe became a 15-inch MLL with only one Walleye ≥18 inches in 2001, and Lynn Lake was added to the 16-inch MLL lakes. The daily limit at Lynn Lake was reduced to two fish, and the one Walleye ≥28 inches was implemented at Reetz Lake in 2002. In 2003, a two fish daily limit began at Middle Lynn, Opitz, and Waubay lakes. A 24-inch MLL with a one fish daily limit was enacted on lakes Beaver, Twin, and Diamond in southeast South Dakota for biocontrol of Black Bullheads in 2003. The 16-inch MLL became a 14-inch MLL at Waubay Lake in 2004. At Belle Fourche Reservoir, a 15-18 inch protected slot limit (PSL) was implemented in 2005. The one Walleye ≥20 inches became a statewide regulation in 2006.

In 2005, MLLs were in place on Walleye populations in 32 South Dakota waters, and one reservoir had a PSL. Walleye daily limits consisted of one, two, and four fish, and two "one over" regulations were in effect in 2005. South Dakota's walleye regulations were substantially more complex since the initial MLLs in 1990. The increase in regulation complexity led to concerns from the general public regarding confusion about lake-specific regulations and from law enforcement staff about accidental noncompliance. Informing anglers about water-specific regulations is complicated when length limits vary among waters and can lead to various enforcement problems (Spencer et al. 2021). This potential confusion over regulations can also lead to a lack of satisfaction among stakeholders in recreational fishing (Spencer et al. 2021).

In 2009, the first South Dakota Walleye Toolbox was completed, and it greatly reduced Walleye regulation complexity by reducing the number of special Walleye regulations from nine to four (Lucchesi and Blackwell 2009). The Walleye Toolbox combined the various MLLs in use across South Dakota into two MLLs; a 15-inch MLL (two fish daily limit, four fish daily limit, and partial-year exemption) and a 28-inch MLL (one fish daily limit). In addition to the two MLLs, the Toolbox also included an experimental regulation category for addressing unique management situations, creating unique fishing opportunities, or researching the effectiveness of new regulation types or ideas.

The 2009 Walleye Toolbox also provided criteria necessary for implementing and evaluating regulations. These criteria have been important in the evaluation of MLLs across South Dakota. Most of the 15-inch MLLs have now been removed from waters in eastern South Dakota primarily because they failed to meet the growth criterion (15 inches by age 4). In 2023, only 16 South Dakota waters have special Walleye regulations (Figure 1). The criteria included in the Walleye Toolbox are important for the potential implementation of proposed regulations by SDGFP staff and those requests that come through the SDGFP Commission petition process.

The 2023 Walleye Toolbox (this document) contains the same regulations as the 2009 Walleye Toolbox, plus the addition of a PSL. The regulations included are for Walleye fisheries with varying rate functions (i.e., recruitment, growth, and mortality), exploitation levels, and differing fishery objectives (Lucchesi and Blackwell 2009). In keeping with the objectives of the original Walleye Toolbox, regulation complexity is kept minimal, and criteria for implementing and evaluating regulations are included.

South Dakota Walleye Regulations
(except Missouri River)

Statewide Regulation
4 fish daily; 1 fish $\geq$20 inches

All waters with the following exceptions:

15-inch MLL; 4 fish daily;
1 fish $\geq$20 inches

Angostura

Shadehill

28-inch MLL;
1 fish $\geq$28 inches

Horseshoe (Day County)

Twin (Minnehaha County)

Reetz

15-inch MLL; 2 fish daily;
1 fish $\geq$20 inches

Curlew

Lynn

Middle Lynn

Newell

Opitz

15–18-inch Protected Slot; 4 fish daily;
1 fish $\geq$20 inches

Belle Fourche

Missouri River

Statewide Regulation
4 fish daily; 1 fish $\geq$20 inches

Oahe

15-inch MLL (July-August exemption);
4 fish daily; 1 fish $\geq$20 inches

Francis Case

Sharpe

15-inch MLL; 4 fish daily;
1 fish $\geq$20 inches

Ft. Randall Dam downstream to Nebraska border

15-inch MLL; 4 fish daily

Gavins Point Dam upstream to Nebraska border

4 fish daily

Gavins Point Dam downstream

Figure 1. Current (January 2023) South Dakota Walleye regulations by water (MLL = minimum length limit).

Statewide Walleye Regulation

The South Dakota statewide Walleye regulation allows for the harvest of four Walleyes daily, of which only one fish in the daily limit can be $\geq$20 inches. The four fish daily limit represents a more conservative limit than surrounding states (five fish – Iowa, Montana, and North Dakota; six fish – Minnesota and Wyoming) except Nebraska, where the statewide daily limit also is four fish. Most South Dakota waters fall into the category of being managed under the statewide regulation and not with a special regulation.

A growing body of literature suggests MLLs may not be the best option for managing Walleyes in harvest-oriented fisheries. Evaluations of MLL regulations generally have found no differences in population metrics between periods having or not having a regulation. In northern Wisconsin lakes, no changes in Walleye growth or population structure were identified after implementing a 15-inch MLL (Fayram et al. 2001). Observed trends in Walleye population age and size structure in two western Minnesota lakes were related to recruitment patterns and growth, not the implementation of MLLs (Isermann 2007). Likewise, recruitment dynamics influenced Walleye abundance and growth rates in two northeast South Dakota lakes and led to the removal of MLL from each lake (Blackwell et al. 2022). Population modeling of three Appalachian Walleye populations suggested that the effects of exploitation on yield, spawning potential, and size structure were similar, with no length regulation or a 15-inch MLL (Smith et al. 2022).

Recruitment and growth dynamics can limit the effectiveness of MLLs at reaching population objectives in many cases. Slow growth reduces the efficacy of MLL regulations when used to manage harvest-oriented fisheries and often leads to declines in angler harvest as slow-growing fish stockpile below the MLL. A large disparity between angler catch rates and harvest rates can indicate a predator-prey system out of balance. Slowing of Walleye growth and stockpiling of fish under 14 inches was identified in three southeast South Dakota lakes managed with a 14-inch MLL leading to the removal of the MLL on these lakes in 2000 (Knapp et al. 2001). Periodic production of large Walleye year classes was found to influence Walleye abundance and growth in Bitter Lake and Waubay Lake, South Dakota, causing the MLL in each lake to not work as intended (Blackwell et al. 2022). In both cases, the MLL was replaced with the statewide regulation. Similarly, the removal of Walleye MLLs from East and West Okoboji Lakes, Iowa, and encouraging angler harvest of small Walleyes was suggested by Larscheid and Hawkins (2005) to provide an increase in growth, decrease natural mortality, and ultimately increase the numbers of large fish. Stockpiling with few fish surpassing 15 inches was found to occur under the 15-inch MLL at Big Creek Lake, Iowa, when the prey base was comprised of centrarchids and percids, and Walleye abundance was high (Krogman et al. 2022). Serns (1978) believed that lakes with a high probability of producing large cohorts of Walleyes should not be managed with length limits, and anglers should be allowed to reduce their abundance otherwise, stunting within the population may occur.

The statewide regulation has no minimum length, but South Dakota anglers tend to have a self-imposed length limit where they begin harvesting Walleyes. The probability an individual fish is harvested likely increases with fish length. However, the probability a fish is harvested can also be influenced by other factors such as catch rates, population size distribution, regulations, and the catches of other species (Chizinski et al. 2014). The first South Dakota 14-inch MLLs provided anglers a reference length where Walleye weight approximated 1 pound. This represented a benchmark length, which many anglers claimed was the minimum size they would harvest (C. Stone, personal communication). However, angler harvest beginning at 14 inches is contrary to what many creel surveys across South Dakota have identified. Recent creel surveys in South Dakota show most harvest begins at approximately 12 inches with occasional smaller fish included. At Belle Fourche Reservoir, anglers primarily started harvesting Walleyes at 12 inches with a few smaller fish harvested during surveys completed during 2006-2012. In the 2019 summer, anglers at Bitter Lake began harvesting Walleyes at 11 inches, but harvest frequency increased at 12 inches. Walleye harvest at Lake Kampeska began at 13 inches during the 2017 summer. On Lake Oahe, angler harvest began at approximately 12 inches in 2019. Similarly, the bulk of angler harvest started at 12 inches on Lake Francis Case during the 2017 and 2018 summers and on Lake Sharpe during the 2018 and 2019 summers. Angler harvest below 12 inches will likely be minimal on most South Dakota waters, and 12 inches probably represents the length where angler harvest begins when not regulated.

Walleye Toolbox Options

<u>15-inch Minimum Length Limit with a Four Fish Daily Limit</u>

Objective:

Protect smaller fish from harvest to increase the average fish size.

Criteria for implementation:

1. Fast growth (15 inches by age 4). Slow growth is acceptable if objective is to increase population abundance and size structure for controlling overabundant panfish or undesirable fish populations.
2. Periods of high exploitation (annual exploitation >30%).
3. Low probability of winterkill.
4. Sporadic or limited natural recruitment requiring frequent stocking.

Criteria for removal:

1. Slowed growth (5+ years to 15 inches) of small fish.
2. Inability to consistently maintain PSD 30-60.
3. Angler dissatisfaction and/or non-compliance.

15-inch Minimum Length Limit with a Two Fish Daily Limit

Objective:

Protect smaller fish from harvest to increase the average fish size and provide a more equitable distribution of angler harvest.

Criteria for implementation:

1. Fast growth (15 inches by age 4).
2. High vulnerability and potential for high exploitation (annual exploitation >50%).
3. Low probability of winterkill.
4. Sporadic or limited natural recruitment requiring frequent stocking.

Criteria for removal:

1. Slowed growth (5+ years to 15 inches) of small fish.
2. Inability to consistently maintain PSD 30-60.
3. Angler dissatisfaction and/or non-compliance.

15-inch Minimum Length Limit with a Partial-Year Exemption

Objective:

Protect smaller fish from harvest to increase the average fish size while allowing some harvest of small fish from large year classes to maintain fast growth.

Criteria for implementation:

1. Fast growth (15 inches by age 4).
2. Periods of high exploitation (annual exploitation >30%).
3. Low probability of winterkill.
4. Periodic recruitment of large year classes or consistent natural production.
5. Periods of high hooking mortality, low fishing pressure, or low catchability.

Criteria for removal:

1. Slowed growth (5+ years to 15 inches) of small fish.
2. Inability to consistently maintain PSD 30-60.
3. Angler dissatisfaction and/or non-compliance.

28-inch Minimum Length Limit with a One Fish Daily Limit

Objectives:

1. To provide a unique fishery with high catch rates for large (≥20 inches) Walleye.
2. To maintain a high abundance of large (≥20 inches) Walleyes capable of controlling over-abundant undesirable fish and panfish populations.
3. To maintain a high-quality fishery in waters close to urban areas and subject to high fishing pressure.

Criteria for implementation:

1. No winterkill.
2. Walleye population is difficult or expensive to maintain.
3. Potential for high exploitation (annual exploitation >30%).

Criteria for removal:

1. Failure to meet objectives (i.e., few fish exceed 20 inches).
2. Angler dissatisfaction and/or non-compliance.

<u>Protected Slot Limit (variable upper and lower bounds)</u>

Objective:

Increase the average fish size while allowing the harvest of small fish to maintain good growth and provide the opportunity to harvest a large Walleye.

Criteria for implementation:

1. Low probability of winterkill.
2. Consistent natural reproduction and recruitment.
3. Slow growth, especially in small fish.
4. High angling pressure.

Criteria for removal:

1. Change in recruitment and mortality rates.
2. Inability to consistently maintain PSD 30-60.
3. Angler dissatisfaction and/or non-compliance.

<u>Experimental Regulations</u>

Objective:

To test new regulations on a limited number of waters under specific time frames.

Criteria for implementation:

1. A need to address a unique management situation that cannot be handled with the statewide or a Toolbox regulation.
2. A need to research new management strategies designed to create a unique fishing opportunities.
3. A need to research the effectiveness of new regulation types and ideas.

Criteria for removal:

1. The experiment failed to meet desired objectives within the designated time frame.
2. Angler dissatisfaction and/or non-compliance.

Support for Regulations in Toolbox

All the regulation choices in the Walleye Toolbox are length based (i.e., MLL or PSL) with some differences in the allowed daily limit. Reduction of exploitation to increase Walleye abundance and size structure are often the main reasons for applying a length limit to a fishery (Brousseau and Armstrong 1987; Isermann and Parsons 2011). Lester et al. (2014) believed the optimal exploitation rate for a Walleye population can be determined by multiplying 0.75 by the natural mortality rate. This relationship translated to an optimal annual exploitation rate of 15-18% for lakes in the Ceded Territory of Wisconsin (Tsehaye et al. 2016). An optimal exploitation rate of 20% for Walleyes was recommended for northern Wisconsin lakes, but the authors indicated that optimal exploitation rates could vary because of lake productivity (Tsehaye et al. 2016). Baccante and Colby (1996) believed few Walleye populations can withstand exploitation levels >30% without a substantial loss of fishing quality, and 25% annual exploitation is probably optimum for productive systems. An annual exploitation rate of 35% was thought to be too high at Big Crooked Lake, Wisconsin because an undesirable Walleye density resulted while subjecting the Walleye population to an annual exploitation rate of 35% for 11 years (Sass and Shaw 2018). Optimal exploitation rates for South Dakota Walleye fisheries are likely between 20% and 30% and annual exploitation rates exceeding 30% will possibly result in reduced fishing quality.

No new MLLs were added to the 2023 Walleye Toolbox to maintain regulation simplicity. In the initial Walleye Toolbox, the 15-inch MLL was selected for inclusion over the 14-inch and 16-inch MLLs to reduce regulation complexity. The 14-inch MLL was not included because previous use in South Dakota failed to show an increase in larger Walleyes, and issues with the slowing of Walleye growth, resulting in fish stockpiling under 14 inches, were common

(Lucchesi and Blackwell 2009). The objectives, criteria, and expected outcomes of the 16-inch MLL were similar to those of a 15-inch MLL negating the need for the 16-inch MLL (Lucchesi and Blackwell 2009). Similarly, the 24-inch MLL was not included in the initial Walleye Toolbox or the 2023 Walleye Toolbox because the objectives were similar to that of the 28-inch MLL. We do not believe additional MLLs are currently needed in the Walleye Toolbox, and the 15-inch MLL and 28-inch MLL will continue to be the only MLLs.

Before applying a regulation, managers must first determine if a regulation is needed based on the biological and social aspects of the fishery. Length-based regulations have often been broadly applied in situations not conducive to being successful at meeting the desired outcomes. This has resulted in the variable success of length-based regulations and can make it difficult to determine if observed changes result from the regulation or other environmental factors.

<u>15-inch Minimum Length Limit (four fish daily limit, two fish daily limit, and partial-year exemption)</u>

The 15-inch MLL includes three Toolbox options; four fish daily limit, two fish daily limit, and a partial-year exemption to the 15-inch MLL. The overall objective of the 15-inch MLL is to protect fish <15 inches from harvest and increase the average fish size within a population. The 15-inch MLL can be implemented on Walleye populations with reasonably fast growth (15 inches at age 4), low natural mortality, low probability of winterkill, limited or sporadic recruitment, and angling exploitation annually exceeds 30%.

A Walleye population objective should be to maintain a balanced population size structure [i.e., proportional size distribution (PSD) = 30-60] over time. Balanced populations occur when their recruitment, growth, and mortality rates are satisfactory (Anderson and

Weithman 1978). However, in northern Wisconsin lakes, Walleye population PSD was found to be more influenced by recruitment and growth than exploitation (Hansen and Nate 2014). The authors cautioned fisheries managers in assuming angler exploitation was a strong driver of Walleye population size structure.

Schmalz et al. (2016) found that in the absence of density-dependent changes in growth, maturity, or mortality, MLLs produced more optimal yield and spawner biomass than not having a MLL for Walleye in Mille Lacs Lake, Minnesota. A 15-inch MLL was thought to provide walleye populations in 13 Wisconsin lakes some degree of protection from overharvest and overexploitation without affecting catch rates, growth, or population structure (Fayram et al. 2001). The authors believed the 15-inch MLL contributed to the stability of the walleye fishery in the northern Wisconsin lakes.

The success of MLLs often hinge on sufficient prey availability to maintain Walleye growth. Gizzard Shad can provide a consistent prey source to promote Walleye growth. In both Lake Francis Case and Lake Sharpe, South Dakota, the presence of Gizzard Shad likely contributes to the consistent good growth rates observed in these two reservoirs. Condition and growth of Walleyes were found to increase after Gizzard Shad became available in Big Creek Lake, Iowa, but was lower when centrarchids and percids comprised the prey base (Krogman et al. 2022).

Two fish daily limit

On lakes where angler exploitation is high (annual exploitation >50%) or has been high in the past, a reduction in the daily limit to two Walleye may distribute harvest more equitably and potentially extend periods of good fishing. Open-access fisheries generally are self-regulating, and fishing effort is reduced once fish abundance declines (Schueller et al. 2012).

Self-regulation is more likely to occur when anglers are highly responsive to changes in fish abundance (Allen et al. 2013), but Hansen et al. (2005) showed that angler catch rates are not always linear with declines in population abundance. When self-regulation does not occur, anglers may exploit Walleyes to low levels (Sullivan 2003; Schmalz et al. 2011). A 15-inch MLL failed to prevent overharvest of Walleyes from Glen Elder Reservoir, Kansas, where the estimated annual exploitation was 68% (Quist 2010).

High harvest may happen in some South Dakota fisheries (e.g., new waters, fisheries close to population centers) when conditions are right. Anglers harvested 16% of the estimated Walleye population within two days of angling, 75% after 16 days, and 79% of the estimated population in 1.5 months from Hazeldon Lake, South Dakota (Blackwell et al. 2019). Hazeldon Lake was a new water that contained an unexploited walleye population when opened to fishing on July 15, 2006. The boom-and-bust fishery on Hazeldon Lake is representative of many new fisheries created in northeast South Dakota during the late 1990s and early 2000s. A reduction from four to two fish daily would have potentially resulted in a 36% reduction in the Walleye harvest during July 15-31 and an 11% reduction during August (Lucchesi and Blackwell 2009). A reduction in the daily limit may have extended the good fishing; however, the estimated reduction does not factor in potential changes in angler behavior.

Partial-year exemption

The inclusion of the partial-year exemption makes the 15-inch MLL regulation similar to a PSL in that it allows anglers to harvest small Walleyes (i.e., <15 inches) but differs in that harvest is only allowed during defined periods. Lakes Francis Case and Sharpe, two South Dakota Missouri River reservoirs, are currently managed with this regulation. The objectives of the regulation are to reduce Walleye harvest during periods when the harvest is traditionally high, reduce release mortality by allowing anglers to harvest Walleyes during a time of year when hooking mortality may be high because of warm water temperatures and/or fish are caught from deep water, and maintain Walleye growth rates by allowing for some harvest of small (i.e., < 15 inches) fish to reduce the potential for slow growth related to the abundance of small Walleyes.

At Lake Francis Case, the regulation was considered successful in meeting the management objectives during 1990-1999 (Stone and Lott 2002). Walleye relative abundance and PSD increased over pre-regulation years, mortality declined for age-2 and -3 fish, and there were no detectable changes in recruitment, condition, or growth rates. More recently (2017-2021), Walleye PSD has ranged from 38-63 and PSD of preferred-length fish (PSD-P) ranged from 2-5, and growth remains good with length at age-3 at capture averaging 15.8 inches for 2012-2021. At Lake Sharpe, Walleye growth is good with a mean length of 14.6 inches at age 3 at capture during 2012-2021, and PSD has ranged from 35-65 and PSD-P from 1-2 during 2017-2021. In both reservoirs, recruitment has generally been consistent, and PSD-P has remained low, indicating annual mortality (natural and angler-induced) likely limits the number of large Walleyes.

<u>28-inch Minimum Length Limit</u>

The use of highly restrictive regulations in Walleye management has not received the attention of other MLL limits (e.g., 14-inch, 15-inch). This paucity of use is likely due to a lack of support from anglers who often desire to harvest Walleyes (Carlin et al. 2012; Haglund et al. 2016; Tingley et al. 2019). Although limited, highly restrictive regulations have been used in a few cases. At Escanaba Lake, Wisconsin, a 28-inch MLL with one fish daily was established in 2003 to increase the Walleye population size structure (Haglund et al. 2016). At Sherman Reservoir, Nebraska, a two-fish daily bag limit within a 15-20 inch harvestable slot and one fish >28 inches is in effect to protect Walleye broodstock (Koupal et al. 2015). Wisconsin includes a 28-inch minimum length limit with a daily bag limit of one fish in the Wisconsin Fisheries Management Regulation Toolbox as a management option to increase angler catch of large Walleyes.

The 28-inch MLL is currently in use on three South Dakota lakes: Horseshoe (Day County), Reetz, and Twin (Minnehaha County). Possible fishery objectives for using this regulation may be to provide anglers with the opportunity for high catch rates of large Walleyes (≥20 inches), maintain a high density of large Walleyes for biocontrol of undesirable fish (e.g., Black Bullhead) and/or panfish (e.g., Bluegill) populations, and maintain high Walleye abundance in waters close to urban areas. The regulation can be implemented in fisheries with a low probability of winterkill, where the potential for exploitation is high (>30%), and in situations where a Walleye population is difficult or expensive to maintain (Lucchesi and Blackwell 2009). Because of the popularity of Walleye harvest with anglers, lakes managed with the 28-inch MLL should be in areas where other opportunities for Walleye harvest exist.

At Reetz Lake, the 28-inch MLL is consider successful at establishing and maintaining a quality Walleye fishery, which has provided a unique angling opportunity for large Walleyes (Blackwell et al. 2020). The estimated number of Walleyes ≥20 inches, gill-net catch per net night (CPUE), and PSD-P trended higher from 2001-2019. At the same time, relative weight (Wr) for the length-groups quality—preferred (15-20 inches) and preferred—memorable (20–25 inches) and the length-at-age at-capture for ages 4 and 5 trended lower. Decreasing trends in Wr and growth were likely related to the increasing Walleye abundance through time. Although declining, the Walleye lengths at age have remained at or above statewide and national averages. The number of angler hours and Walleye catch rates are highest during the summer when most Reetz Lake anglers target Walleye. The high abundance of large Walleye appears to have led to a stock-recruitment relationship where Walleye recruitment has been sufficient to negate the need for stocking since 2002. High Walleye abundance and high catch rates of large fish are important in maintaining angler use at Reetz Lake.

At Twin Lake (Minnehaha County), the Walleye gill-net CPUE averaged 10 fish per North American gill net for 2012-2021, PSD averaged 84, and PSD-P averaged 44. These values indicate a Walleye population exhibiting high abundance and large size structure. In 2007, the abundance of large fish was high, summer (May-August) angling effort (25 hours/hectare) was high, and the catch rate for Walleyes was high at 1.4 Walleye/hour fished (Lucchesi et al. 2015). Fishing pressure at Twin Lake has remained high, and angler opinions of the regulation generally are favorable (D. Lucchesi, personal communication). Like Reetz Lake, the abundance of large Walleyes appears to have led to a stock-recruitment relationship where Walleye recruitment has been sufficient to forgo supplemental stocking since 2012. The regulation is successful at maintaining angling opportunities for large Walleyes close to Sioux Falls, South Dakota's largest urban area.

<u>Protected Slot Limit</u>

Protective slot limits can improve population size structure by allowing harvest of small, slow-growing fish and protecting fish within the protected slot. Brousseau and Armstrong (1987) recommended that Walleye populations exhibit high recruitment, slow growth especially of small fish, high natural mortality of small fish, and high angling effort when implementing a PSL. Anglers must be willing to harvest fish below the minimum length of the PSL for the regulation to be effective. The lower and upper limits have not been defined in the 2023 Walleye Toolbox to provide managers with flexibility depending on a water's Walleye growth rates and the objectives for the fishery.

A 15-18 inch PSL with only one fish >18 inches in the daily limit was implemented in 2005 at Belle Fourche Reservoir to direct angler harvest towards smaller Walleyes and improve the population size structure. The management goal for the Walleye size structure was to maintain a PSD of 30-60 and PSD-P ≥10. Since implementation, the Walleye size structure (gill net PSD range 53-81 for the years 2017-2021) has approximated the PSD goal but has failed to increase the number of preferred-length Walleyes in the population (gill net PSD-P range 0-3 for the years 2017-2021). Young Walleyes currently have good growth, typically reaching 15 inches at age 3. However, growth slows for fish within the protected slot, and Walleyes do not exceed 18 inches until age 7. Lyons (2021) indicated the Walleye PSL at Belle Fourche Reservoir achieved the goal of increasing the harvest of small Walleyes to improve growth; however, growth slows within the PSL and likely is the result of high Walleye abundance within the PSL resulting in density-dependent growth. Annual mortality (angler harvest may comprise a high percentage) for Walleyes >18 inches is sufficient to keep the percent of 20-inch fish in the population low. If one of the management goals for Belle Fourche Reservoir continues to be increase PSD-P and provide anglers with high catch rates for preferred-length Walleyes, then the limits of the PSL will likely need to be modified. Most interviewed anglers have been supportive of the PSL on Belle Fourche Reservoir (G. Galinat, personal communication).

A 17-22 inch PSL was implemented in 2007 at Spirit Lake, East Okoboji, West Okoboji, and Storm Lake, Iowa, because Walleye abundance below the MLL was increasing, growth was not permitting fish to exceed the MLL, and few broodstock-size fish were available (Meerbeek 2021). A goal of the PSL in these Iowa lakes was to increase the harvest of sub-broodstock-size Walleyes by allowing anglers to harvest the small fish and hopefully reduce intraspecific competition for food resources within cohorts. The number of available broodstock increased in Spirit Lake, East Okoboji, and West Okoboji in the years following the implementation of the PSL. At Storm Lake, the Walleye population more consistently met the objectives than when managed with the previous MLL. In 2021, male Walleyes made up a disproportionate number of fish compared to females within the PSL in the four lakes. To alleviate the stockpiling of males within the PSL, Meerbeek (2021) suggested modifying the 17-22 inch PSL to a 19-25 inch PSL. A change to a 19-25 PSL should increase the yield of male Walleyes while continuing to protect female broodstock. Modeling of Walleye population characteristics of the Walleye populations in Cheat Lake and the Monongahela River, West Virginia, suggested a PSL was the best regulation to conserve the spawning stock and increase the number of Walleyes >25 inches (Smith et al. 2022).

Experimental Regulations

There currently are no experimental Walleye regulations in use across South Dakota. The previous experimental 15-18 inch PSL on Belle Fourche Reservoir became a Toolbox regulation in the updated 2023 South Dakota Walleye Toolbox (this document). Experimental regulations allow for testing new ideas in South Dakota Walleye management. Implementation of an experimental regulation requires justification with valid objectives for the fishery and a time-bound plan for evaluation (Lucchesi and Blackwell 2009).

Experimental regulations will be subject to the SDGFP Commission Rules Development (CRD) process to gain approval for implementation. Similar to other regulation changes, a 10-year evaluation plan will accompany any experimental regulations. After 10 years, the regulation will either become a Walleye Toolbox regulation or be removed. The regulation can be removed earlier if deemed detrimental to the fishery or angler compliance is low.

A harvestable slot limit (HSL) is a regulation that may be worth exploring as an experimental regulation at some point in South Dakota Walleye management. Ahrens et al. (2019) suggested that a HSL is superior to a MLL across several yield- and catch-based objectives. A HSL would allow for the harvest of fish of intermediate ages and lengths, which should allow for maintaining high harvest (desired by many Walleye anglers) and potentially result in a more natural population age structure versus a truncated age structure that often results from MLLs. A more natural age structure could provide a more favorable stock-recruitment relationship, which could lead to an increase in natural recruitment resulting in a reduced need for supplemental stocking. Restricting the harvest of the large individuals in sexually dimorphic species, such as Walleye, favors the survival of large reproductive-age females (Wszola et al. 2022). Modeling results have shown that a HSL will provide greater numbers of harvested fish and greater catches of trophy fish while conserving reproductive biomass and a more natural age structure than a MLL (Gwinn et al. 2015).

A HSL was enacted on the Walleye population in Sherman Reservoir, Nebraska, in 2009. The HSL goal was to protect broodstock while still providing anglers with the ability to harvest two Walleyes daily within the 15-20 inch HSL along with including one Walleye more than 28 inches in the two fish limit (Koupal et al. 2015). The regulation was found to increase the protection of female Walleyes by more than 90% but decreased the protection afforded to males by more than 60%. As a result, the number of female broodstock collected more than doubled during spring spawning operations, but the relative abundance of males declined. Angling effort was similar pre- and post-regulation, but Walleye harvest increased by 130% under the HSL over the previous 18-inch MLL (four fish daily).

Regulation Process

Proposed regulation changes are developed by aquatics staff within each Fisheries Management Area before being brought forward and identified as a possible new regulation. Regulation ideas need to be supported by biological data and be socially acceptable. New regulation ideas will follow the Aquatics SDGFP CRD Process. New Walleye regulations will be included in the list of ideas during an all-Department meeting for brainstorming regulation ideas held early in the year. Submitted ideas are discussed in a second meeting to determine which ideas will move forward and any staff assignments. Further discussion on potential regulation changes will occur at the summer Fisheries Management Team meeting and the summer Fisheries Meeting. Aquatics supervisory staff will meet with the Department Secretary and Wildlife Division Director to finalize recommendations to move forward to the SDGFP Commission. Regulation recommendations are presented to the SDGFP Commission in July, and the Commission can propose the regulation change, modify the regulation change prior to proposal, or deny a recommended regulation change. Rule changes must be open for public comment for 30 days before being finalized, modified, or denied by the SDGFP Commission at the September meeting. New regulations finalized by the SDGFP Commission generally take effect on January 1 of the upcoming year.

Petition Process

The public can petition the SDGFP Commission concerning Walleye regulation changes at any time. When a petition is received, the SDGFP Commission must act (initiate the process or deny) within 30 days. At this point, the SDGFP Commission can consult with aquatics staff to determine how a petitioned Walleye regulation change fits into the Walleye Toolbox. Data that have been collected or can be collected will be used to guide the Department’s recommendation of action by the SDGFP Commission. If the SDGFP Commission proposes a petitioned Walleye regulation change, the proposed change will be open for public comment for 30 days and finalized, modified, or denied at the next SDGFP Commission Meeting.

Recommending and Evaluating Regulations

Biological data and angler use and harvest data (i.e., creel) are important when recommending special regulations and evaluating regulations. Ideally, adequate biological and social data will have been collected before a regulation change is proposed. All regulation changes, including citizen’s petitioned regulation changes, will need to be evaluated through the collection of biological data. In many cases, human dimension data gained either through creel surveys or broader questionnaire surveys will also be used in the evaluation.

Immediate population changes are not expected following the enactment of a regulation. Because of this, a 10-year evaluation period is included in the evaluation period before declaring a regulation change a failure or a success. The biological effects of regulation changes may not be apparent until the entire population has been subjected to nothing but the new regulation (Fayram and Schmalz 2006). In an evaluation of Walleye MLLs in Minnesota, Isermann (2007) believed that statistical comparisons of pre- and post-regulation population parameters may be confounded because some of the observed post-regulation characteristics were partially a product of pre-regulation conditions. Differences in population parameters resulting from enacting a MLL for White Crappie and Largemouth Bass were more likely to be identified with a 5-year evaluation versus a 3-year evaluation (Allen and Pine 2000). When a 17-22 inch PSL was enacted in Iowa lakes Spirit, East Okoboji, West Okoboji, and Storm in 2007, the abundant 2001 cohort was only exposed to angler harvest for 1.5 years before entering the 17-22 inch protected slot (Meerbeek 2021). This temporarily exacerbated density-dependent growth of the Walleye population before the projected improvements occurred in the fishery.

Sufficient data are not always available and will need to be collected, when and where possible. Walleye growth, recruitment, abundance, mortality, angler exploitation, and angler behavior are included in the criteria for the various Walleye Toolbox regulations. Preferably, measures or estimates of these parameters are needed for proposing and evaluating regulations. Population responses to regulation changes can be modeled (e.g., Fisheries Analysis and Modeling Simulator [FAMS]; Slipke and Maceina 2014) prior to a regulation change to see potential outcomes. Long-term annual sampling is best to monitor population trends before implementing a regulation and as part of the evaluation. However, the sampling frequency is dependent on SDGFP priorities and available resources. Thus, sampling plans need to be considered as a part of all regulation changes to ensure proper evaluation. High-profile waters will require annual fish community sampling and possible integration of angler use and harvest surveys (creel) and/or human dimension surveys during the 10 years post-regulation implementation. The fish communities of lower-profile waters will be surveyed a minimum of three times during the 10-year evaluation period. At the end of the 10-year evaluation, a report of the findings will be completed, which will include a recommendation of whether or not the regulation should continue. If a fisherie's objective changes during the 10-year evaluation period, the regulation will be recommended for removal if it no longer supports the new objective.

Walleye populations considered for a new regulation or as part of an evaluation of a current regulation will need to be sampled with experimental gill nets to determine relative abundance, size structure, condition, estimate growth, estimate annual mortality, and characterize recruitment. Gill nets are the recommended gear for sampling Walleyes in standing water (Miranda and Boxrucker 2009), and Isermann and Parsons (2011) noted that agencies most often sample Walleyes with gill nets, usually fished on the bottom overnight or for 24 hours. Collected Walleyes will be measured for total length, weighed, and sagittal otoliths removed from a subsample (e.g., five fish per cm-length group, when available) for age estimation.

Estimating population abundance is rarely completed because it requires considerable effort, but relative abundance estimates can provide managers with an index to population abundance. Relative abundance of stock-length (≥10 inches; Gabelhouse 1984) Walleyes can be quantified using CPUE (the number of fish/net night). When multiple years of gill net data are available, trends or possible changes in CPUE can be assessed. An abundance index can be developed for qualitatively classifying population abundance as low, moderate, or high based on CPUE values.

The size structure of a population provides a snapshot that reflects the interactions of recruitment, growth, and mortality (Neuman and Allen 2007). Length-frequency histograms can show the distribution of fish sizes in a population. They can also be useful in assessing year class strength, identifying missing year classes, growth of individual cohorts, or determining at what fish size annual mortality may be excessive. Walleye population size structure can be quantified using PSD and PSD-P (Guy et al. 2007). Minimum lengths for stock, quality, and preferred are

10, 15, and 20 inches (Gabelhouse 1984). Objectives for sustained PSD are defined for the various regulations included in the Toolbox and can be set for populations managed with a special regulation. Regulation evaluation efforts need to be such that PSD values from multiple years can be used to determine if the PSD objective is being attained. Single-year estimates of PSD were found to have little value for judging population balance because of annual variability in PSD and single values above or below the objective range may not be indicative of the long-term status of a population (Hansen and Nate 2014).

Walleye plumpness (condition) can be an indicator of current predator-prey dynamics (Blackwell et al. 2000). Skinny fish and high angler catch rates may indicate a predator-prey relationship out of balance. Body condition is generally dynamic depending on the season; the highest values occur in the spring before spawning, followed by a decline after spawning, and then an increase through the summer and fall. Walleye body condition can be measured using Wr (Blackwell et al. 2000). To examine if condition changes with Walleye lengths for a given water, Wr can be plotted by length or mean Wr values can be calculated by length categories (e.g., stock—quality, quality—preferred, and preferred—memorable) and compared.

Sagittal otoliths are used to estimate Walleye ages, and an age-length key is used to assign ages to fish not aged. Mean lengths at age at capture for various ages (e.g., age 4) can be calculated. Mean length at capture at age 4 can be used to assess whether or not Walleyes are reaching 15 inches at age 4, or a von Bertalanffy growth curve can be calculated to estimate the age when fish reach 15 inches. Mean length at age can be assessed when multiple years of data are available (e.g., pre-regulation, regulation).

Total annual mortality encompasses both natural and angler-induced mortality. A weighted catch curve can be used to estimate total annual mortality (Ricker 1975). Weighting gives equal weight to each age, deflating the influence of older and rarer ages in the sample. Assumptions for catch curves include constant recruitment, constant mortality, and equal catchability for all ages. Although recruitment is rarely consistent, reasonable estimates of mortality typically can be derived for species that exhibit erratic recruitment (Allen 1997). Successive years of age data can be combined to lessen the influence of erratic recruitment and small sample sizes (Miranda and Bettoli 2007). Separating total mortality into natural and angler induced can be labor and time intensive. Angler exploitation can be estimated from tag returns (corrected for non-reporting, tag loss, and mortality) and angler harvest estimates if a population estimate is known. However, published natural mortality estimators have been shown to provide reasonable natural mortality estimates in five other freshwater species (Maceina and Sammons 2016) and can provide general guidance on mortality components when angler exploitation data are lacking.

Recruitment can be assessed as the relative abundance of age-3 (or another age when considered recruited to the sampling gear or the fishery ~12 inches) annually observed, and recruitment variability can be evaluated with the coefficient of variation (CV) of age-3 gill-net CPUE when long-term data are available. Additionally, year class strength can be assessed using studentized residuals from the catch curves for each sampled year (Maceina 1997). Positive residuals suggest strong year classes, and negative residuals imply weak year classes. If multiple years of age estimates are available, an average of the residuals for each cohort can provide an index of year-class strength. When only a single-year sample is available, the recruitment variability index (RVI; Guy and Willis 1995) provides an assessment of recruitment. Values of RVI range from -1 to 1, with positive values indicating less recruitment variability. Quist (2007) found that RVI values based on a single year of age structure data were significantly related to empirical estimates of recruitment variation in eight Kansas reservoirs.

Creel surveys can estimate the amount of fishing pressure and the number of Walleyes caught and harvested by anglers from a water. In addition, aspects of angler behavior, regulation compliance, and angler satisfaction can be gained from creel surveys. Information collected during and calculated from creel surveys can assist in regulation evaluation. The number of fish harvested and/or the harvest rate can provide a qualitative estimate of exploitation. Low angler compliance likely reduces the effectiveness of a regulation. Angler dissatisfaction with a regulation may keep people from fishing a lake. When Walleye catch rates are high and harvest is low, it may indicate stockpiling of Walleyes below the MLL (i.e., <15 inches). Unfortunately, creel surveys cannot always be part of a regulation evaluation because they are labor intensive and expensive to conduct. In addition, the remoteness of some waters reduces the ability of aquatic's staff to conduct a creel survey, and often the data collected in remote settings are too limited to make reliable parameter estimates.

Understanding the public attitudes and desires regarding fisheries and the management of the fisheries is important. Human dimension surveys completed through email and the internet, can be used to target all licensed anglers or specific groups of anglers. Decker and Krueger (1993) indicated that questionnaires and surveys are an excellent means for gaining information from the public. Surveys can gain public input before a regulation change and during the evaluation period. Internet surveys provide an efficient and inexpensive feedback mechanism for fish and wildlife agencies to serve their constituents (Henderson and Gigliotti 2018). Involving the public in the management and evaluation of regulations can help to ensure that the public's interests are considered, can improve their understanding the goals of a fishery, and ultimately gain public support of fisheries management actions.

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